

NOAA RESEARCH 2001



The *Aquarius*, the only underwater laboratory in the world



A porthole view of the *Aquarius* bunk room



Autonomous Underwater Vehicles (AUVs) will expand the geographic range of observations

Sea Floor Observatories

NOAA Request

NOAA's Office of Oceanic and Atmospheric Research (OAR) requests an additional \$3.1 million within its Marine Environmental Research line item to maintain existing shallow water observatories and develop new deep-sea observatories. This program is part of the America's Ocean Future Initiative.

Background

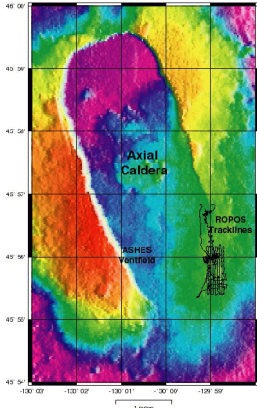
Sea floor observatories are the next generation of technological tools for understanding the oceans. Permanent and temporary sea floor stations are important laboratories that house and power a wide variety of 'in place' sampling tools and sensors for studying and monitoring the ocean. Studies conducted through the use of sea floor observatories increase understanding of important chemical, physical and biological processes which are best understood at a few well-monitored sites. The net result gathered from these stations will provide a better understanding of ocean processes and resources leading to more informed policy choices as ocean development progresses.

Proposed Actions

- **Improve and expand sea floor observatories in shallow coastal waters off New Jersey and Florida. Continue use of AUVs to enhance coastal monitoring and expand range of observations.**

LEO-15: The *Leo-15* is comprised of two unmanned sea floor observatories which are located in 15 meters of water off the coast of New Jersey. The Long Term Environmental Observatory (LEO) is linked to the Rutgers Marine Field Station in Tuckerton, NJ, via an electro-optic cable for information transfer. Expansion of LEO -15's capabilities will include addition of a deeper offshore node that will allow modeling of currents and flux of pollutants from the coast to the deep sea. Development of a new node in the New York and New Jersey harbor region will improve environmental management and vessel traffic safety as part of the PORTS system.

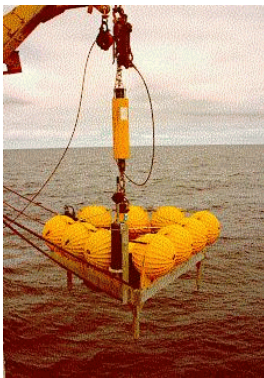
Autonomous Underwater Vehicles (AUVs) such as the *LEO-15 REMUS* enhance coastal monitoring and multiple vehicle survey operations through a partnership between NURP and the Office of Naval Research. OAR will focus on making existing systems, like *REMUS* and *ABE* (Autonomous Benthic Explorer), operational and available to the science community. These vehicles will also allow U.S. oceanographic researchers to expand the geographic range of current observations.



Bathymetric map of *NeMO* Observatory at Axial Volcano, a mile-deep seamount about 300 miles off the Oregon coast



Lava from Axial Volcano



Volcanic System Monitors (called "Rumblemeters") are PMEL-developed multi-sensor instruments designed for *in situ* monitoring of deep sea volcanic activity

Aquarius Undersea Laboratory: The *Aquarius*, deployed in the Florida Keys in 1993, is the world's only laboratory beneath the sea. Planned enhancements will increase *Aquarius*' data collection operations from manned mission days per year to year round. The habitat, owned and operated by NOAA/National Undersea Research Program (NURP), is located in 20 m of water at the base of a coral reef within the Florida Keys National Marine Sanctuary, an ideal site for studying the health of sensitive coastal and coral ecosystems.

- **Develop two new deep-water observatories to monitor the sea floor activity off the coast of the Pacific Northwest and in the Gulf of Mexico, while planning for future expansion to other regions**

New Millennium Observatory (NeMO): The Pacific Marine Environmental Laboratory (PMEL) completed the first phase establishing the *NeMO* sea floor observatory on the summit of a mile-deep volcano about 300 miles off the Oregon coast in 1998. *NeMO* monitors an active sea floor venting site on the Juan de Fuca Ridge for hydrothermal and seismic activity and samples thermophilic bacteria. *NeMO* will send real-time data to shore and accommodate an autonomous underwater vehicle (AUV) to respond to events detected and located within the observatory region by an acoustic monitoring system.

Gulf of Mexico Observatory: The Gulf of Mexico is one of the Nation's largest and most productive ecological systems and is closely linked to a significant portion of the Nation's economy. Several candidate sites and applications exist for a long-term 'in place' observatory. Possible sites include a location near the hypoxic water mass that forms each summer near the Mississippi River mouth, oil and gas seeps on the outer continental shelf and slope, or in the Flower Gardens Banks National Marine Sanctuary, located about 110 miles off the coasts of Texas and Louisiana.

Benefits

NOAA's accomplishments in underwater science have been impressive. However, the vast unknown resources of this last frontier demand that NOAA be aggressive in its exploration of the undersea environment if the potential of these untapped resources is to be realized. This request is intended to allow NOAA to use data collected from sea floor observatories to help build sustainable fisheries, sustain healthy coasts, learn about ocean bio-diversity and ecosystems in extreme environments, as well as understand and predict environmental change.

Examples include:

- Research and monitoring generated at the *LEO-15* will assist management of living resources in the region, including the \$100 million per year (in NJ) surf clam industry and a recreational fishery valued at \$50 million per year.
- Observations gathered from the *Aquarius* will contribute to management of several commercial operations, including fish and ornamental corals, valued at over \$40 million per year in the Keys.
- *NeMO* will serve as an early warning system for seismic activity and potential tsunami threats, thus assisting protection of lives and many billions of dollars of property on the northwest coast.